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Mangroves are salt tolerant marshy vegetation found mainly along the tropical and subtropical intertidal regions of the world comprising trees and shrubs, adapted to thrive in shallow, muddy, salt and brackish waters. The canals, creeks and the estuarine environment provide home for a wide variety of aquatic fauna and the arid zone forms the nesting grounds for aquatic birds. Mangroves constitute the breeding and nursery grounds for the larvae and juveniles of commercially important species of prawns, fishes and molluscs. The litterfall supports a host of detritivorous animals such as amphipods, mysids, harpacticoids, molluscs, crabs, larval prawns and fishes. Production of surplus quantities of plant detritus, dissolved organic matter, recycling of nutrients, provision of adequate habitats for aquaculture, larval recruitment of coastal fisheries stock make the mangrove ecosystem a unique environment of great ecological value. Mangrove forests also play a significant role in stabilizing shore line or coastal bed. Most of the mangrove areas have been converted for paddy cultivation, coconut plantation, aquaculture, harbour development and other activities. With a view to identify mangrove habitats, biodiversity, and their impact on marine fishery resources, a reconnaissance survey was conducted along the northern parts of Kerala coast under the National Agricultural Technology Project to assess and evaluate the ecosystem.

### 1. Chettuva

A good mangrove area is located on the eastern side of the Chettuva highway bridge in the estuarine area formed by the rivers, Chettuva puzha and Karanira puzha. The perennial bar mouth connecting the sea is about 1.5 km west of the mangrove formation. The dominant vegetation is *Rhizophora mucronata* forming a dense column of 4-8 m height on the periphery of the shallow mud flats which extends to about 500 m in a

North-South direction and the middle portion is interrupted by tidal pools and creeks bordered by the shrub, *Acanthus ilicifolius*. Other species such as *R. apiculata*, *Avicennia officinalis*, *Aegiceros corniculatum*, *Clerodendron inerme* were encountered along with dense coconut farms on the landward side. There is a sustenance fishery for fin-fishes, crustaceans and bivalves. The juveniles of *Penaeus indicus* are collected during December-February from the mangrove areas for aquaculture. This mangrove habitat was selected for detailed investigation as per the objectives of the National Agricultural Technology Project.

### 2. Ponnani

Discontinuous patches of mangrove vegetation was observed near the fort area where brackish water ponds and creeks co-exist. Developmental activities paved the way for sand filling and reclamation of mangrove habitat resulting in their degradation followed by succession of beach runners and creepers such as *Ipomoea* sp. and *Clerodendron*. Therefore the area is not considered for regular investigation.

### 3. Kadalundi

The Kadalundi river with a width over 600 m joins the sea through a permanent bar mouth and forms a wide estuary close to the railway bridge across the river. Although patchy mangrove plants such as *R. mucronata*, *Excoecaria agallocha*, *Aegiceros corniculatum*, and *Acanthus ilicifolius* etc. grow on isolated sand banks below the bridge, a fairly extensive area of 10 ha is located on the eastern side dominated by dense *Avicennia officinalis* of 6-7 m height. The pneumatophores of *A. officinalis* are so abundant that they form a kind of fencing on the margin of low tide mark. Dense algal mats comprising species of *Enteromorpha inestinalis* and *Chaetomorpha linza*. are found entangled on the roots and in some locations floating algal mats cover the surface of tidal pools. Numerous seedlings of *Avicennia* are established in the low tidal margin. *Rhizophora* seedlings / samplings

are planted in the tidal pools as a measure of conservation. Kadalundi mangroves are selected for detailed studies.

#### 4. Mahe, Koduvally & Dharmadam estuaries

During a survey of Mahe, Tellicherry and Dharmadam estuaries, it was found that the mangroves around Mahe estuary are unsuitable for investigation, due to human interference. The Koduvally-Dharmadam river complex with mangrove vegetation is found ideal and has been taken for regular observations. On the eastern side of the highway bridge close to Tellichery Co-operative hospital is the principal estuarine area, which is fringed with dense growth of *Rhizophora* spp. and *Avicennia officinalis*. The formation is undulate enclosing tidal pools at intervals, which again are bordered with *Acanthus ilicifolius*, *Excoecaria agallocha*, *Aegiceros corniculatum* and *Thespesia populnea*. On the western side of the bridge there is an isolated column of old trees of *Sonneratis* sp. in the land ward side. The shallow areas on the river side are planted mainly with *Rhizophora* saplings which are around 3-4 year old at present. On the northern side, vegetation including *Kandelia candel* are patchy and mixed. All the mangrove areas here are protected by Forest/Highways Department under 'Mangrove Park' for conservation and education programmes.

#### 5. Nadal

Isolated mangrove of about 2.0 ha could be seen fringing the brackish waters on either side of the

Kannur-Valapattanam road dominated by dense coconut groves indicating human interference. Although trees and the mangrove fern *Acrostichum aureum* are present, this area is not found suitable for regular studies from fisheries point of view.

#### 6. Valapattanam

The Valapattanam estuary and backwaters are extensive by covering a distance of 7-8 km from the coastline. The Valapattanam river banks are occupied by many wood based industries and coconut farms. However on the eastern side of the Valapattanam highway bridge an extensive mangrove area of about 20 ha is found undisturbed where species of *Avicennia*, *Rhizophora*, *Kandelia* and *Acanthus* are common. The creeper *Derris trifoliata* was seen along with isolated growths of *Aegiceros corniculatum*. The middle portion of the river has a depth range of 5 to 7 m and tidal currents are strong while on the northern side is having isolated patches of *Kandelia candel*. This mangrove has been chosen for investigations as it is found as a favourable niche for brackish water fishes.

#### 7. Ezhimala (Kunjimangalam)

Relatively good mangrove area of around 18 ha is situated in the estuarine environment formed by Pullamcode puzha and Kunjimangalam river towards 1 km north east of Ezhimala Railway Station. With the railway bridge as a reference point, the banks of Pullemcode puzha on its eastern side is embellished with discontinued shrubby *Avicennia* formation which becomes dense towards

Mangrove vegetation along the Kerala coast (North of Cochin)

Name	Position	Vegetation cover (Approx.)
1. Chettuva	10°32'14.5"N-76°03'01"E	2.0 hectare
2. Ponnani	10°46'58"N-75°55'09"E	0.2 hectare
3. Kadalundi	11°07'36"N-75°50'02"E	
4. Koduvally, Dharmadam	11°45'50"N-75°28'41.3"E	10.0 hectare
5. Nadal	11°49', 32"N-75°25'57"E	2.0 hectare
6. Valapattanam	11°45'50"N-75°28'44"E	
7. Ezhimala (Kunjimangalam)	12°01'05"N-75°13'52"E	18.0 hectare
8. Thalankara (kasaragod)		0.2 hectare
9. Kumbala	12°35'49"N-74°56'28"E	20.0 hectare

south where the river dips into a large tidal pond. The waterfront of this pond is occupied by dense shrubs of *Acanthus ilicifolius* behind which tall and luxuriant *Rhizophora mucronata* occur interrupted in some sections by *R. apiculata*, of glabrous dark green foliage. The extensive water body is joined here by small canals and creeks giving the shape of island like mud flats, which are colonized, by *R. mucronata*, *A. officinalis*, *Kandelia candel* in association with *Clerodendron inerne*, *Aegiceros corniculatum* *Excoecaria agallocha*. The fresh water canal has a sluice gate to divert fresh water for irrigation purpose on the eastern side. Some of the paddy fields where cultivation is discontinued show surgent growth of *Avicennia* shrubs along with terrestrial associated growths of *Acrostichum*, *Pandanus*, *Mimosa*, *Pongamia*, *Thespesia* etc. Coconut groves predominate beyond this stretch of plants. The mangroves from feeding ground for many aquatic birds such as painted stork, egrets, cormorants, grey heron, king-fisher and juveniles of fishes and prawns. Ezhimala has been selected to assess its biodiversity.

### 8. Thalankara - Kasaragod

This mangrove area is near the Chandragiri estuary, most of which is reclaimed with sand filling which subsequently got reduced to degraded *Avicennia* and *Acanthus* shrubs and hence not selected.

### 9. Kumbbla

A good mangrove area of about 20 ha was located in the Kumbbla estuary 10 km north of Kasaragod. The estuarine system is contributed by Shiriya or Kumbbla river basin. The mangrove formation is around the middle portion of the Kumbbla river on the eastern side of the highway bridge. The principal vegetation is a dense cover of *Avicennia* trees growing to a height of 6-8 m, the tidal ponds further on the eastern and southern side are bordered with *Rhizophora* sp., with prop roots standing 2-4 m above ground. The heights of these trees get progressively reduced where it is joined by *Aegiceros corniculatum* and *Avicennia* shrubs. The mud flats get exposed during low tide, show the presence of oyster beds,

gastropod shells and an abundant population of fiddler crabs. There are a number of estuarine fishes in the creeks.

In all, nine mangrove areas from Chettuva to Kumbbla in the north were surveyed to appraise the extent of the mangrove area, the species composition, the characteristics of water bodies covering them and also the status with reference to biotic pressure and development activities. The ecosystem which have been affected by human interference are not selected for regular investigations. Comprehensive studies are planned to be conducted during the tenure of the project keeping in the view of the main objectives such as biodiversity and its influence on the fisheries wealth. Six mangroves of great ecological value from fisheries point of view have been chosen namely Chettuva, Kadalundi, Koduvallu, Valapattanam, Kunjlmangalam and Kumbbla. Any changes in the upstream areas and the river basins where mangroves are being projected and developed will also be studied.

#### Mangrove species available in Kerala coast North of Cochin

Name	Family
1. <i>Aegiceros corniculatum</i>	Euphorbiaceae
2. <i>Avicennia officinalis</i>	Verbenaceae
3. <i>Acanthus ilicifolius</i>	Acanthaceae
4. <i>Rhizophora apiculata</i>	Rhizophoraceae
5. <i>Rhizophora mucronata</i>	Rhizophoraceae
6. <i>Sonneratia</i> spp.	Sonneratiaceae
7. <i>Bruguiera cylindrica</i>	Rhizophoraceae
8. <i>Kandelia candel</i>	Rhizophoraceae
9. <i>Excoecaria agallocha</i>	Euphorbiaceae
10. <i>Clerodendron inerne</i>	Verbenaceae
11. <i>Derris trifoliata</i>	Leguminosae

In addition a number of associate species are available, which are not true mangrove plants.

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